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Notes:

1. Untranslatable words are replaced with asterisks (*).
2. Texts in the figures are not translated and shown as it is.

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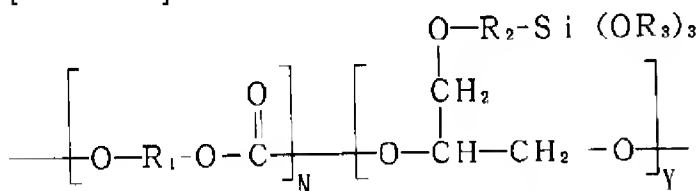
Dictionary: Last updated 03/28/2008 / Priority: 1. Chemistry

CLAIM + DETAILED DESCRIPTION

[Claim(s)]

[Claim 1] The carrier for electrostatic latent image development characterized by having a resin enveloping layer containing the polycarbonate compound shown with a following general formula (1) on a core material.

[Formula 1]



R_1 : 2価のアルキレン基、アリール基
 R_2 : 炭素数1～5の2価のアルキレン基
 R_3 : 炭素数1～3のアルキル基
 $\text{N} : \text{Y} = 1 : 1 \sim 1 : 0.01$ 、 $\text{N} = 30 \sim 5000$

[Claim 2] The electrostatic latent image developer which consists of a carrier according to claim 1 and toner.

[Claim 3] The image formation method characterized by developing negatives using a developer according to claim 2 in the image formation method of developing the electrostatic latent image on electrostatic latent image support, using the developer layer on developer support.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the carrier for electrostatic latent image development used for developing the electrostatic latent image on electrostatic latent image support, a developer, and the image formation method.

[0002]

[Description of the Prior Art] Conventionally, an electrophotography method forms an electrostatic latent image using various means on a photo conductor or an electrostatic recording object, the electrostatic nature particles called toner to this electrostatic latent image are made to adhere, and, generally the method of developing an electrostatic latent image is used. In this development, using the two component developer which consists of carrier grains called a carrier and toner grains, both were mixed, frictional electrification was carried out mutually, and the charge positive [of an adequate amount] or negative is given to toner.

[0003] Although divided roughly into the coat carrier which generally has a coated layer on the surface, and the non-coat carrier which does not have a coated layer on the surface, since the direction of the coat carrier is excellent when a developer life etc. is taken into consideration, various coat carriers are developed and the carrier is put in practical use.

[0004] It is giving moderate electrostatic property (the amount of charges, and charge distribution) to toner, although there are various characteristics required of a coat carrier, Especially the thing for which the electrostatic property of toner is not changed to environmental variations, such as maintaining the suitable electrostatic property of toner over a long period of time for this reason shock resistance demanded, abrasion resistance and humidity, and temperature, is important, and various coat carriers are proposed.

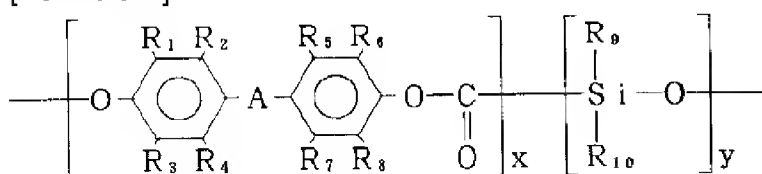
[0005] As one of the how to raise the shock resistance of for example, a coat carrier, and abrasion resistance It is indicated to JP,S64-29858,A that the method of applying various coupling agents to the core material surface, and raising the adhesion of a core material and a coat layer to it covers the grains containing an electrification control agent with mechanical power to core material again at JP,S59-200259,A.

[0006] Although it will be improved about the adhesion of core material and a coat layer if these methods are used, Since the substance which has an electrification control facility is used in that case, it originates in this substance, electrification quantity changes with environmental change a lot, and the problem of a toner component adhering to a carrier with progress of time in the system is mentioned.

[0007] Moreover, to JP,H7-84413,A, the carrier which covered magnetic substance grains with resin containing the polydyorganosiloxane polycarbonate block copolymer expressed with a following general formula (2) is indicated.

[0008]

[Formula 2]



x及びyは共重合割合を示す。

[0009] Although it is indicated that the shock resistance of a carrier and the electrification grant stability to toner are improved by adoption of said binding resin, and this carrier is excellent in development nature and a developer life, receive said binding resin. Even if it covered to the core material using further various coupling agents and produced the coat carrier, it was not what the adhesion of a core material and a coat layer cannot be raised, and deterioration with the passage of time is accepted in the system also about toner stain resistance, and can be satisfied. When full color toner was used especially, by the extreme increase in the fall of the electrification quantity under high-humidity/temperature, or the electrification quantity under low-humidity/temperature, the stability of the developer fell, long-term use cannot be borne, and there were problems, such as producing KABURI and concentration nonuniformity of a picture.

[0010] As mentioned above, the carrier coat material excellent in adhesion and shock resistance required in order to make the life of a developer fully extend, toner-proof stain resistance, etc. is not yet found out.

[0011]

[Problem(s) to be Solved by the Invention] Then, this invention tends to offer the long lasting carrier for electrostatic latent image development, developer, and the image formation method of solving the above-mentioned problem, being excellent in adhesion with the core material of a carrier, having shock resistance and abrasion resistance, and having an effect in the stain resistance to toner etc. Moreover, this invention tends to offer the carrier for electrostatic latent image development suitable for using with color toner.

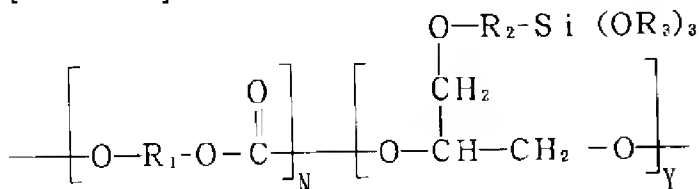
[0012]

[Means for Solving the Problem] This invention succeeded in solution of the above-mentioned technical problem by adopting the following composition.

(1) The carrier for electrostatic latent image development characterized by having a resin enveloping layer containing the polycarbonate compound shown with a following general formula (1) on a core material.

[0013]

[Formula 3]



R₁ : 2価のアルキレン基、アリール基

R₂ : 炭素数1～5の2価のアルキレン基

R₃ : 炭素数1～3のアルキル基

N: Y = 1 : 1 ~ 1 : 0. 0 1、N = 3 0 ~ 5 0 0 0

[0014] (2) The above (1) characterized by using magnetic material grains as it was as a core material Carrier for electrostatic latent image development of a description.

(3) The above (1) characterized by using the grains which distributed magnetic material powder in binding resin as a core material Carrier for electrostatic latent image development of a description.

[0015] (4) The above (1) made to react under existence of phase transfer catalysis in the organic solvent which dissolves polycarbonate resin of a raw material, and a glycidyloxy machine content silane coupling agent The manufacture method of the carrier for electrostatic latent image development characterized by covering the polycarbonate compound of a description on a core material.

[0016] (5) The above (4) characterized by adding basic catalysts, such as sodium hydroxide, in a little water and water, and promoting a crosslinking bond on the occasion of the above-mentioned reaction The manufacture method of the carrier for electrostatic latent image development a description.

[0017] (6) Above (1) - (3) Electrostatic latent image developer which consists [any / one] of a carrier of a description, and toner.

(7) The above (6) characterized by using color toner Electrostatic latent image developer of a description.

[0018] (8) In the image formation method of developing the electrostatic latent image on electrostatic latent image support using the developer layer on developer support, it is the above (6). Or (7) The image formation method characterized by developing negatives using the developer of a description.


[0019]

[The mode of implementation of invention] [the polycarbonate compound shown by the general formula (1) used for this invention] Since the structure causes the core material surface and crosslinking reaction of a carrier and a firm film is formed, the polycarbonate frame by which has the adhesion which is not in the former and an orientation is carried out to the surface [low surface energy nature] And since it had abrasion resistance and shock resistance, offer of the carrier for electrostatic latent image development which has the outstanding resistance to contamination over toner, and is equal to prolonged continuous use with little environment dependency as a result was enabled. And offer of the method of forming the good picture which does not have the nonuniformity or KABURI of a picture to an environmental change was enabled.

[0020] The polycarbonate compound used by this invention is expressed with the above-mentioned general formula (1), and, specifically, can mention the thing of a description to the following tables 1-7.

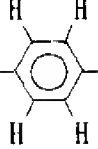
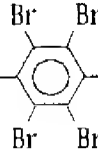
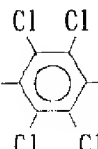
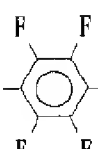

[0021]

[Table 1]

構造No	R ₁	R ₂	R ₃
1	$-(\text{CH}_2)_2-$	$-(\text{CH}_2)_3-$	$-\text{CH}_3$
2	$-(\text{CH}_2)_6-$	$-(\text{CH}_2)_5-$	$-\text{C}_2\text{H}_5$
3	$-(\text{CH}_2)_2-\underset{\text{CH}_3}{\text{CH}}-$	$-(\text{CH}_2)_2-$	$-\text{CH}_3$
4	$-(\text{CH}_2)_4-\underset{\text{CH}_3}{\text{CH}}-$	$-(\text{CH}_2)_2-$	$-\text{C}_2\text{H}_5$
5	$-\text{CH}_2-\underset{\text{CH}_3}{\overset{\text{CH}_3}{\text{CH}}}-$	 $-\text{CH}_2-$	$-\text{C}_3\text{H}_7$
6	$-(\text{CH}_2)_2-\underset{\text{CH}_3}{\overset{\text{CH}_3}{\text{CH}}}-$	$-(\text{CH}_2)_2-$	$-\text{CH}_3$

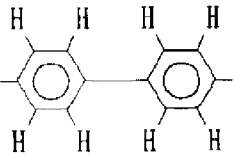
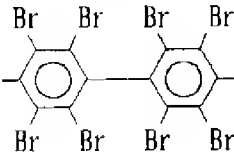
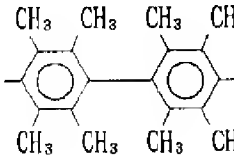
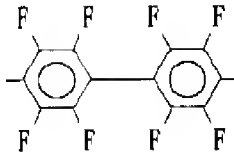
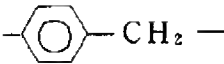
[0022]

[Table 2]

構造No	R ₁	R ₂	R ₃
7		$-(\text{CH}_2)_3-$	$-\text{CH}_3$
8		$-(\text{CH}_2)_3-$	$-\text{C}_2\text{H}_5$
9		$-(\text{CH}_2)_2-$	$-\text{C}_2\text{H}_5$
10		 $-\text{CH}_2-$	$-\text{CH}_3$

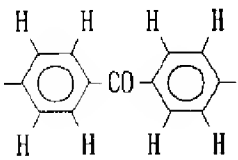
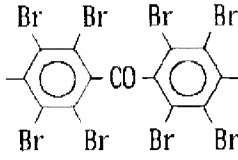
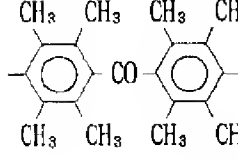
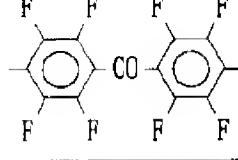
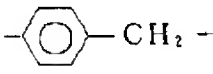
[0023]

[Table 3]

構造No	R ₁	R ₂	R ₃
1 1		$-(CH_2)_3-$	$-CH_3$
1 2		$-(CH_2)_3-$	$-C_2H_5$
1 3		$-(CH_2)_2-$	$-C_2H_5$
1 4			$-CH_3$

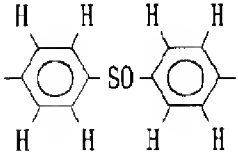
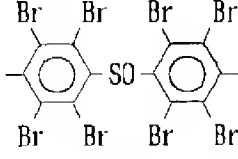
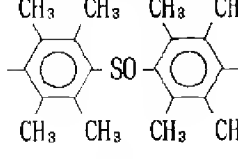
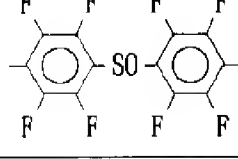
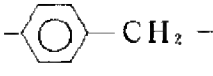
[0024]

[Table 4]

構造No	R ₁	R ₂	R ₃
1 5		$-(CH_2)_3-$	$-CH_3$
1 6		$-(CH_2)_3-$	$-C_2H_5$
1 7		$-(CH_2)_2-$	$-C_2H_5$
1 8			$-CH_3$

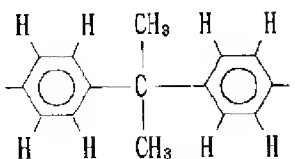
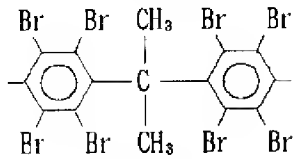
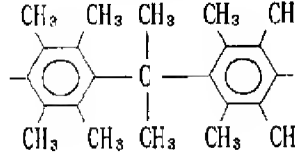
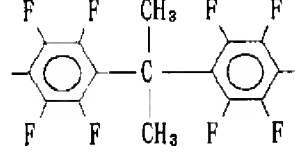
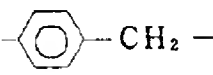
[0025]

[Table 5]

構造No	R ₁	R ₂	R ₃
1 9		$-(CH_2)_3-$	$-CH_3$
2 0		$-(CH_2)_3-$	$-C_2H_5$
2 1		$-(CH_2)_2-$	$-C_2H_5$
2 2			$-CH_3$

[0026]

[Table 6]

構造No	R ₁	R ₂	R ₃
2 3		$-(CH_2)_3-$	$-CH_3$
2 4		$-(CH_2)_3-$	$-C_2H_5$
2 5		$-(CH_2)_2-$	$-C_2H_5$
2 6			$-CH_3$

[0027]

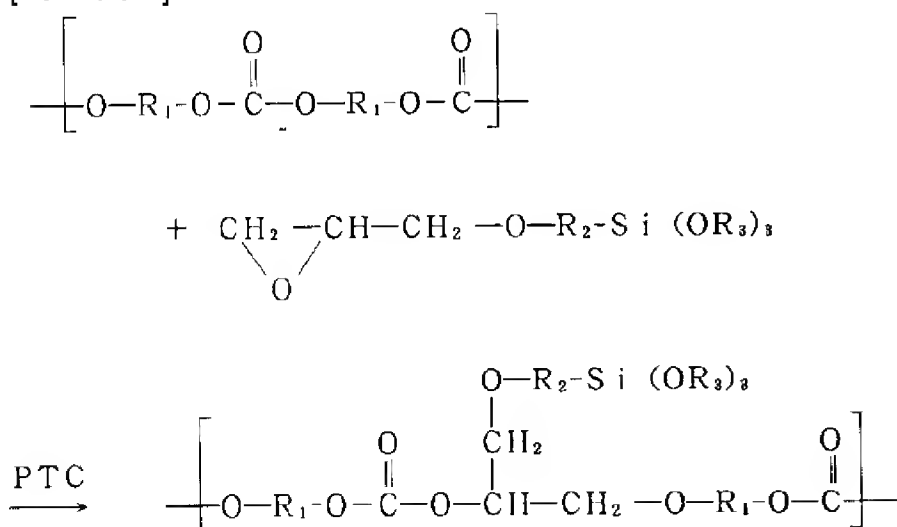
[Table 7]

構造No	R ₁	R ₂	R ₃
27		$-(CH_2)_3-$	$-CH_3$
28		$-(CH_2)_3-$	$-C_2H_5$
29		$-(CH_2)_2-$	$-C_2H_5$
30			$-CH_3$

[0028] The polycarbonate compound used by this invention is compoundable with the following reaction formula. (Refer to "J.Appl.Poly.Sci.Vol.56 and pp 1-8" (1995))

[0029]

[Formula 4]



R₁ : 2価のアルキレン基、アリール基
R₂ : 炭素数1～5の2価のアルキレン基
R₃ : 炭素数1～3のアルキル基
PTC : 相間移動触媒

[0030] As polycarbonate resin used as the raw material of the above-mentioned polycarbonate compound For example, polyethylene carbonate, Pori bisphenol A carbonate, Pori biphenyl carbonate, Pori biphenyl sulfone carbonate, Polyphenyl carbonate, Pori benzophenone carbonate, PORIPA bromo phenyl carbonate, polyperfluoro phenyl carbonate, Pori bisphenol A F carbonate, etc. can be mentioned.

[0031] [the glycidylloxy machine content silane coupling agent used in order to compound the above-mentioned polycarbonate compound] For example, 3-glycidylloxypropyl trimethoxysilane, 3-glycidylloxy propyl triethoxysilane, 2-glycidylloxy ethyltrimethoxysilane, glycidylloxy methyl trimethoxysilane, 4-(glycidylloxy) benzyl trimethoxysilane, etc. can be mentioned.

[0032] By the way, the above-mentioned polycarbonate compound is made to react using phase transfer catalysis in the organic solvent which dissolves this resin with the polycarbonate resin which serves as a raw material in the above-mentioned glycidylloxy machine content silane coupling agent, and is compounded. As phase transfer catalysis used in order to compound polycarbonate resin [compounds, such as a crown ether derivative, quarternary ammonium salt, and a phosphonium salt, and a concrete target] Tetramethyl ammonium chloride, tetraethyl ammonium chloride, Tetra-n-butyl ammonium Promid, tetraethyl ammoniumchloride, Crown ATERU, such as quarternary ammonium salt, such as benzyl trimethylammonium chloride and tetraethylammonium FURORIDO, the 4th class phosphonium salts, such as n-butyl triphenyl phosphonium bromide, and 12 crown 4-ether, can be mentioned.

[0033] moreover, as an organic solvent which dissolves polycarbonate resin used as a raw material Dichloromethane, trichloroethane, toluene, acetone, xylene, methyl ethyl ketone, methyl isobutyl ketone, dimethyl formamide, etc. are those to which a glycidylloxy machine content silane coupling agent does not react. If it is the organic solvent which dissolves polycarbonate resin used as a raw material, it can be used regardless of the kind.

[0034] A well-known magnetic material can be used for the core material used by this invention. Magnetic oxide grains, such as iron powder, and magnetite, ferrite, and the particulate material which distributed these powder to thermoplastics or a thermosetting resin can specifically be mentioned, and using these independently can also be used together. Moreover, as an example of the thermoplastics which distributes magnetic oxide powder, such as iron powder, and magnetite, ferrite, or a thermosetting resin, polyolefine system resin, polyester resin, polyurethane resin, polycarbonate resin, a melamine resin, a phenol resin, etc. can be mentioned.

[0035] The range of 0.01-10 micrometers of mean particle diameter of the magnetic powder in a magnetic powder distributed carrier is 0.05-5 micrometers preferably. Moreover, as for the mean particle diameter of the core material of this invention, a 10-500-micrometer thing is used and a 30-150-micrometer thing is used more preferably.

[0036] As a method of covering the above-mentioned Pori KABONETO compound on these core material surfaces ** The dip coating which immerses a core material into the solvent for enveloping

layer formation, the spray method which sprays the solution for ** enveloping layer formation on the surface of a core material, ** A core material can be made to be able to float with fluidization air, the solution for enveloping layer formation can be mixed with a core material in the fluidized bed process which sprays the solution for enveloping layer formation, and ** kneader KOTA, and the kneader KOTA method for removing a solvent etc. can be mentioned.

[0037] In addition, in order to make the core material surface carry out the crosslinking bond of the above-mentioned polycarbonate compound firmly, it is good to set preferably 30-250 degrees C of drying temperatures as the range of 50-200 degrees C. Moreover, it is desirable to promote a crosslinking bond by adding a little water, distilled water, or the thing that added the basic catalyst of sodium hydroxide, potassium hydroxide, sodium carbonate, potassium carbonate, etc. to these when covering.

[0038] The solvent used for the coating solution for enveloping layer formation can be used regardless of the kind, if said Pori KABONETO compound can be dissolved. The metaphor can use ether, such as ketone, such as aromatic hydrocarbon, such as toluene and xylene, acetone, and methyl ethyl ketone, tetrahydrofuran, and dioxane, etc. In addition, 0.1-10 micrometers of the ranges of 0.1-5.0 micrometers are [thickness of said enveloping layer] usually suitable preferably.

[0039]

[Example] 10.0g of polyethylene (example of compound synthesis of structure No.1) carbonate resin which explains this invention in detail according to a work example hereafter [weight average molecular weight (Mw) 50,000 and value of gel permeation chromatography (GPC)], As a glycidyoxy machine content coupling agent, [3-glycidy oxy-propyltrimethoxysilane 1.0g (4.23mmol)] Dissolving in dichloromethane 100ml, adding tetraethylammonium bromide 0.05g (0.16mmol) as phase transfer catalysis, and heating slowly, dichloromethane is removed, and removal operation was ended and it was made to react after that in the place where the internal temperature became 60 degrees C for 24 hours.

[0040] Some acquired resultants were extracted, and when the solid matter which deposited in addition to light petroleum was analyzed by NMR, it was checked that it is the object of structure No.1. In addition, in the [-izing 1] type, it was N:Y=1:1 and was N= 570. The remaining resultants were used as carrier covering material as they were.

[0041] (Example of compound synthesis of structure No.10) instead of polycarbonate resin of the example 1 of compound synthesis Polyperfluoro phenyl carbonate resin [weight average molecular weight (Mw) 70,000 and gel-permeation-chromatography (GPC) value] is used, and it is a glycidyoxy machine content coupling agent. Except having used 4-(glycidyoxy) benzyl trimethoxysilane, it was made to react like the example 1 of compound synthesis, and the object of structure No.10 was obtained (it checks by NMR). In addition, in the [-izing 1] type, it was N:Y=1:1 and was N= 340. The resultant was used as carrier covering material as it was.

[0042] (Example of compound synthesis of structure No.23) Instead of polycarbonate resin of the

example 1 of compound synthesis, it is [Pori bisphenol A carbonate resin [weight average molecular weight (Mw) 60,000 and gel-permeation-chromatography (GPC) value] and] as a glycidyoxy machine content coupling agent. Except having used 3-glycidy oxy-propyltrimethoxysilane, it was made to react like the example 1 of compound synthesis, and the object of structure No.23 was obtained (it checks by NMR). In addition, in the [-izing 1] type, it was N:Y=1:1 and was N= 240. The resultant was used as carrier covering material as it was.

[0043] (Example of compound synthesis of structure No.28) Instead of polycarbonate resin of the example 1 of compound synthesis, it is [Pori bisphenol A F carbonate resin [weight average molecular weight (Mw) 80,000 and gel-permeation-chromatography (GPC) value] and] as a glycidyoxy machine content coupling agent. Except having used 3-glycidy oxy-propyltrimethoxysilane, it was made to react like the example 1 of compound synthesis, and the object of structure No.28 was obtained (it checks by NMR). In addition, in the [-izing 1] type, it was N:Y=1:1 and was N= 80. The resultant was used as carrier covering material as it was.

[0044] [Work example 1] Polycarbonate resin of structure No.1 is dissolved in toluene so that solid content weight may become 10%, and it is a core material of a carrier. This magnetite-particles 100 weight part is received using magnetite particles with a mean particle diameter of 50 micrometers. Said polycarbonate resin solution was added so that solid content weight might become 1.2 weight part, kneader KOTA performed coating and carrying at 80 degrees C, and the coat carrier of 0.25 micrometer of thickness was obtained.

[0045] [Work example 2] Polycarbonate resin of structure No.10 is dissolved in methyl ethyl ketone so that solid content weight may become 10%, and it is a core material of a carrier. This ferritic grain 100 weight part is received using Cu-Zn system ferritic grain with a mean particle diameter of 50 micrometers. Said polycarbonate resin solution is added so that solid content weight may become 1.2 weight part. Furthermore, the distilled water of 1.0 weight part was added to the polycarbonate resin 100 weight part, kneader KOTA performed coating and carrying at 100 degrees C, and the coat carrier of 0.25 micrometer of thickness was obtained.

[0046] [Work example 3] Polycarbonate resin of structure No.14 is dissolved in tetrahydrofuran so that solid content weight may become 10%, and it is a core material of a carrier. A grain with a mean particle diameter of 50 micrometers which distributed the end of magnetite powder (mean particle diameter of 0.5 micrometer, 80 weight %) is used for Pori urea. To this particulate material 100 weight part, said polycarbonate resin solution is added so that solid content weight may become 1.2 weight part. Furthermore, 1.0 weight ***** kneader KOTA performed coating and carrying for the sodium hydroxide solution of concentration at 100-120 degrees C 0.1weight % to the polycarbonate resin 100 weight part, and the coat carrier of 0.25 micrometer of thickness was obtained.

[0047] [Work example 4] Polycarbonate resin of structure No.17 is dissolved in tetrahydrofuran so that solid content weight may become 10%, and it is a core material of a carrier. This magnetite-particles 100 weight part is received using magnetite particles with a mean particle diameter of 40

micrometers. Said polycarbonate resin solution was added so that solid content weight might become 1.2 weight part, kneader KOTA performed coating and carrying at 100 degrees C, and the coat carrier of 0.25 micrometer of thickness was obtained.

[0048] [Work example 5] Polycarbonate resin of structure No.20 is dissolved so that solid content weight may become 10% at dimethyl formamide, and it is a core material of a carrier. This magnetite-particles 100 weight part is received using magnetite particles with a mean particle diameter of 40 micrometers. Said polycarbonate resin solution was added, kneader KOTA performed coating and carrying at 150 degrees C so that solid content weight might become 1.2 weight part, and the coat carrier of 0.25 micrometer of thickness was obtained.

[0049] [Work example 6] Polycarbonate resin of structure No.23 is dissolved in toluene so that solid content weight may become 10%, and it is a core material of a carrier. This magnetite-particles 100 weight part is received using magnetite particles with a mean particle diameter of 50 micrometers. Said polycarbonate resin solution was added so that solid content weight might become 1.2 weight part, kneader KOTA performed coating and carrying at 100 degrees C, and the coat carrier of 0.25 micrometer of thickness was obtained.

[0050] [Work example 7] Polycarbonate resin of structure No.28. is dissolved in toluene so that solid content weight may become 10%, and it is a core material of a carrier. This magnetite-particles 100 weight part is received using magnetite particles with a mean particle diameter of 50 micrometers. Said polycarbonate resin solution was added so that solid content weight might become 1.2 weight part, kneader KOTA performed coating and carrying at 90 degrees C, and the coat carrier of 0.25 micrometer of thickness was obtained.

[0051] [Comparative example 1] Set in the work example 2. The polyperfluoro phenyl carbonate resin [weight average molecular weight (Mw) 70,000 which is a starting material about polycarbonate resin, Except having used gel-permeation-chromatography (GPC) value], it processed like the work example 2 and the carrier which does not intercalate a silane coupling agent was obtained.

[0052] [Comparative example 2] Instead of polycarbonate resin in a work example 6, Pori bisphenol A carbonate resin [weight average molecular weight (Mw) 60,000, The Cu-Zn system ferritic grain with a mean particle diameter of 50 micrometers used for the core material is coated with 3-aminopropyl trimethoxysilane using gel-permeation-chromatography (GPC) value]. Except having used, it processed like the work example 6 and the carrier was obtained.

[0053]

(Production of the toner for measurement)

100 weight % of line polyester resin (terephthalic acid/bisphenol A) An ethyleneoxide addition product / SHIKUROHEKI Line polyester; Tg obtained from SANJI methanol = 62 degrees C, Mn=4100, Mw= 35,000, acid number =12, water acid number =25

Magenta pigment (C. I. pigment red 57) After it kneaded the above-mentioned mixture by the extruder 3weight % and the jet mill ground, the classification was carried out with the wind power type

classifier, and the d50=8micrometer magenta toner grain was obtained.

[0054] (Evaluation) The above-mentioned magenta toner 8 weight part was mixed to the carrier 100 weight part obtained by the work example and the comparative example, the developer was adjusted, it applied to the electrophotography copying machine (the Fuji Xerox make, A-Color630), and the copy test was done. The result was shown in Table 8. In addition, electrification quantity is a value by the image analysis of CSG (charge SUPEKUTORO graphic method) among Table 8.

[0055]

[Table 8]

	初期画像 (中温中湿)		10枚複写後のトナー帯電量 ($\mu\text{C}/\text{g}$)			1万枚複写後の トナー帯電量 ($\mu\text{C}/\text{g}$) 中温中湿	1万枚複写後のキャリア 表面の電子顕微鏡観察	
	カブリ	濃度ムラ	高温高湿	中温中湿	低温低湿		被膜の剥れ	トナー付着
実施例1	なし	なし	-22.3	-23.6	-24.5	-22.5	なし	なし
実施例2	なし	なし	-20.0	-20.7	-21.2	-20.1	なし	なし
実施例3	なし	なし	-20.0	-21.5	-19.8	-20.1	なし	なし
実施例4	なし	なし	-20.0	-22.0	-21.2	-21.1	なし	なし
実施例5	なし	なし	-19.8	-21.7	-20.8	-20.1	なし	なし
実施例6	なし	なし	-20.0	-20.7	-21.8	-20.1	なし	なし
実施例7	なし	なし	-19.8	-21.7	-20.8	-20.1	なし	なし
比較例1	発生	発生	-19.3	-18.5	-20.4	-14.1	有り	有り
比較例2	なし	なし	-18.3	-21.0	-23.7	-15.2	有り	有り

[0056] The picture in which not all the developers using the carrier of the work example have KABURI and concentration nonuniformity was obtained so that clearly from Table 8. The image density of these pictures was also stable with around 1.3, and they showed stable toner electrification quantity also to environmental change. Furthermore, although the carrier surface after 10,000 copies was observed with the electron microscope about carrier covering material peeling, carrier covering material peeling could not be observed and neither the external additive on the surface of a carrier nor adhesion of a toner component was also observed so that clearly from Table 8.

[0057] On the other hand, in the case of the developer using the carrier of the comparative example 1, concentration nonuniformity was seen. Although the picture without KABURI and concentration nonuniformity was obtained, in the case of the developer using the carrier of the comparative example 2, toner electrification quantity was low, and it was unstable also to environmental change. [of electrification quantity] If the toner electrification quantity after 10,000 copies is carrying out the remarkable fall of the comparative examples 1 and 2 and electron microscope observation of the carrier surface of the comparative example 1 after 10,000 copies and a comparative example 2 is furthermore carried out, Peeling of carrier covering material was observed partly, and the embedding (it observes as a fall of toner electrification quantity) of the external additive on the surface of a carrier

and adhesion of a toner component were also observed.

[0058]

[Effect of the Invention] The above-mentioned composition is adopted in this invention. Therefore, even if it excels in the adhesion to a core material, and it enables offer of the carrier for electrostatic load development which has abrasion resistance and resistance to contamination, and environment changes or it uses it by prolonged continuation, the stable electrification grant capability is shown and offer of a good picture without the nonuniformity and KABURI of a picture is enabled.

[Translation done.]